

EXHIBIT B

Supplemental Declaration of Bruce P. Lanphear, M.D.,
M.P.H.

**IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF MICHIGAN
SOUTHERN DIVISION**

CONCERNED PASTORS FOR SOCIAL
ACTION, et al.,

Plaintiffs,

v.

NICK A. KHOURI, et al.,

Defendants.

Case No. 16-10277

Hon. David M. Lawson

Mag. J. Stephanie Dawkins Davis

**SUPPLEMENTAL DECLARATION OF
BRUCE P. LANPHEAR, M.D., M.P.H.**

I, Bruce Lanphear, do hereby affirm and state:

Introduction

1. I am a medical doctor. My expertise, educational background, employment, certification as a medical specialist in general preventative medicine and public health, research focus areas, and membership on public health advisory groups and task forces are described in the Declaration of Bruce P. Lanphear, M.D., M.P.H. dated March 23, 2016. *See* ECF No. 27-9. I incorporate by reference my March 23, 2016 declaration and the exhibits attached thereto in their entirety.

2. All of the information set forth in this declaration is based upon my education, personal knowledge, and experience as well as my personal review of Exhibits 2 through 11 of the Declaration of Bruce P. Lanphear, M.D., M.P.H. dated March 23, 2016, and Exhibits 1 through 3 attached to this declaration.

Cumulative effects of lead exposure

3. There is no safe level of exposure to lead. Even at very low levels, exposure to lead has serious impacts on children's health.

4. Childhood lead exposure is associated with a wide array of irreversible neuropsychological and developmental effects. Increased levels of lead in blood can result in lower IQs, diminished academic achievement, increased risk of attention-related disorders, such as ADHD, and increased risk of problem behaviors, like conduct disorder. Lead exposure is also a strong predictor of

behaviors linked with criminality, including impulsivity, hyperactivity, and aggressive behaviors. These associations remain even for children with very low blood lead levels (below 5 µg/dL).¹

5. The impacts of lead exposure are cumulative. The adverse effects of lead exposure on cognition and behavior build up as a result of continued exposure to lead over time.

6. There is evidence that, while both acute exposures and cumulative lead exposure adversely affect childhood brain development, cumulative lead exposure over time is a stronger predictor of long-term adverse outcomes than short-term peak exposure to lead. For example, children's blood lead levels measured at ages 5-6 were more strongly associated with adverse health impacts than peak blood lead levels measured during early childhood (ages 0-2), suggesting that lead exposure throughout childhood—not just early peak exposure—significantly affects negative health outcomes.²

7. Given the importance of cumulative exposures on long-term outcomes for children—including children who have been exposed to lead in drinking water

¹ U.S. Dep't of Health & Human Servs., Nat'l Toxicology Program, *Health Effects of Low-Level Lead* xviii (2012) (ECF No. 27-9, Ex. 6); Bruce P. Lanphear, *The Impact of Toxins on the Developing Brain*, 36 Annual Rev. Public Health 211, 221 (2015) (ECF No. 27-9, Ex. 10).

² Christopher J. Brubaker, et al., *The Influence of age of lead exposure on adult gray matter volume*, NeuroToxicology (2010) (online ed.) (Exhibit 1).

over the past two years—the evidence indicates that they will benefit if their present and future lead exposure is reduced.

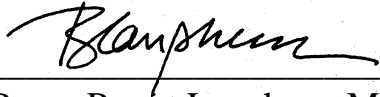
Spikes in lead water levels

8. It is my understanding that the publicly available data from tap water monitoring in Flint continue to show intermittent spikes in lead levels, as high as 5,986 parts per billion (ppb).³ These spikes occur sporadically, and have occurred in homes that, when previously sampled, showed low or non-detectable lead levels. For instance, the home that showed a spike of nearly 6,000 ppb in November 2016 showed lead levels of only 3 ppb when sampled in July 2016, and non-detectable levels when sampled in August. Another home that showed a lead level of 5 ppb when sampled in November 2015 showed a spike of 2,069 ppb when sampled again in December 2016. A different household showed non-detectable lead levels when sampled in September 2016, but spiked to nearly twenty times the 15-ppb action level when sampled again in November.

9. Although these spikes represent only a very small percentage of the samples collected, they are concerning. Spikes this high can pose a hazard to children's health, and could be responsible for worrisome elevations in blood lead concentrations.

³ See State of Michigan, Taking Action on Flint Water, Residential Sampling, http://www.michigan.gov/flintwater/0,6092,7-345-76292_76294_76297---,00.html (last visited Dec. 22, 2016) (Exhibits 2 and 3).

I declare under penalty of perjury that the foregoing is true and correct.

A handwritten signature in black ink, appearing to read "B. Lanphear", written over a horizontal line.

Bruce Perrin Lanphear, MD, MPH

December 27, 2016

Date

INDEX OF EXHIBITS

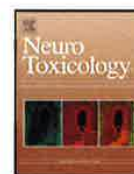
Exhibit	Description
1	Christopher J. Brubaker, et al., The Influence of age of lead exposure on adult gray matter volume, NeuroToxicology (2010) (online ed.)
2	Flint Residential Testing Report Sorted by Address, results collected July 1 through December 12, 2016 (posted December 15, 2016), retrieved from www.michigan.gov/flintwater/ (excerpts)
3	Flint Residential Testing Report Sorted by Address, results collected through June 30, 2016 (posted July 11, 2016), retrieved from www.michigan.gov/flintwater/ (excerpts)

EXHIBIT 1



Contents lists available at ScienceDirect

NeuroToxicology



The influence of age of lead exposure on adult gray matter volume

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ABSTRACT

Childhood lead exposure is associated with decreased cognitive abilities and executive functioning localized within the prefrontal cortex. Several studies have observed stronger associations between blood lead measurements obtained later in life than earlier measures, but there are no imaging studies investigating the developmental trajectory of blood lead levels taken during childhood on adult gray matter volume. In this study, we recruited 157 adults (20.8 ± 1.5 years of age) from the Cincinnati Lead Study to undergo high resolution volumetric magnetic resonance imaging. Adjusted voxel-wise regression analyses were performed for associations between adult gray matter volume loss and yearly mean blood lead levels from 1 to 6 years of age in the entire cohort and by sex. We observed significant inverse associations between gray matter volume loss and annual mean blood lead levels from 3 to 6 years of age. The extent of prefrontal gray matter associated with yearly mean blood lead levels increased with advancing age of the subjects. The inverse associations between gray matter volume loss and yearly mean blood lead measurements were more pronounced in the frontal lobes of men than women. Analysis of women yielded significantly weaker associations between yearly mean blood lead levels and gray matter volume at all ages than either men or the combined cohort of men and women together. These results suggest that blood lead concentrations obtained during later childhood demonstrate greater loss in gray matter volume than childhood mean or maximum values. The relationship between childhood blood lead levels and gray matter volume loss was predominantly observed in the frontal lobes of males. This study demonstrates that maximum blood lead levels do not fully account for gray matter changes associated with childhood lead exposure, particularly in the frontal lobes of young men.

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1. Introduction

Lead is an environmental toxicant with documented effects on human cognition (Baghurst et al., 1992; Bellinger et al., 1992; Canfield et al., 2003; Dietrich et al., 1993a; Lanphear et al., 2005; Schnaas et al., 2000; Wasserman et al., 1997), behavior (Dietrich et al., 2001; Needleman et al., 1996; Stretesky and Lynch, 2004; Wright et al., 2008), and brain structure (Cecil et al., 2008; Stewart et al., 2006).

While mean and maximum childhood blood lead levels have long been regarded as the standard metrics of childhood lead exposure, several studies have noted stronger associations between neurobehavioral outcomes and blood lead levels mea-

sured in later childhood than either mean or maximum childhood blood lead levels (Bellinger et al., 1992; Chandramouli et al., 2009; Chen et al., 2007, 2005; Ris et al., 2004; Schnaas et al., 2000; Tong et al., 1996; Wasserman et al., 1997). In Cecil et al. (2008), we demonstrated the adjusted association between mean childhood lead levels and adult gray matter volume loss using a voxel based morphometric analysis of volumetric magnetic resonance imaging (MRI) obtained from a longitudinal birth cohort. The purpose of this study was to investigate if later childhood blood levels were more strongly associated with neuroanatomical changes than mean or maximum childhood blood lead levels.

2. Methods

2.1. Participants

The Cincinnati Lead Study (CLS) is an urban, inner-city birth cohort with detailed prenatal and postnatal histories of low to moderate lead exposure and behavioral outcomes monitored over

Abbreviations: MR, magnetic resonance; MRI, magnetic resonance imaging; VBM, voxel based morphometry; GM, gray matter; WM, white matter.

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Table 1Characteristics of the children and of their mothers in the Cincinnati Lead Study ($N=157$) with comparison by sex.

Characteristic	Cohort	Range	Men ($N=83$)	Women ($N=74$)	p value
Mean childhood blood lead concentration ($\mu\text{g/dL}$)	13.3 ± 5.9	4.6–37.2	13.6 ± 6.3	13.1 ± 5.5	0.50
Maximum blood lead concentration ($\mu\text{g/dL}$)	23.1 ± 11.2	7.8–83.2	23.5 ± 11.0	22.7 ± 11.6	0.64
Age at Max Pb level (months)	23.4 ± 10.8	3–66	23.6 ± 11.5	23.2 ± 10.0	0.85
Age at imaging (years)	20.8 ± 0.9	19.7–24.3	20.8 ± 0.9	20.9 ± 0.9	0.50
Gestational age (weeks)	39.4 ± 1.7	35–43	39.5 ± 1.7	39.4 ± 1.7	0.38
Birth weight (g)	3103 ± 468	1814–4260	3137 ± 508	3075 ± 412	0.63
SES, 78 months	18.1 ± 5.1	11–49	18.9 ± 5.7	17.6 ± 4.3	0.80
IQ-FSIQ at 7 years	86.7 ± 11.9	50–116	85.2 ± 12.1	88.2 ± 11.6	0.89
Educational level (20 years)	11.5 ± 1.4	8–16	11.3 ± 1.3	11.6 ± 1.6	0.78
Maternal FSIQ	75.3 ± 8.7	55–100	74.6 ± 8.1	76.0 ± 9.4	0.75
Marijuana usage	76 positive (48%)		46 positive (55%)	30 positive (41%)	0.95
Maternal alcohol usage	24 yes (15%)		11 yes (13%)	13 yes (18%)	0.65
Maternal tobacco usage	71 yes (45%)		35 yes (42%)	36 yes (49%)	0.68
Maternal marijuana usage	18 yes (11%)		9 yes (11%)	9 yes (12%)	0.43

Abbreviations: SES, Hollingshead Socioeconomic Status; FSIQ, full scale intelligence quotient, p value represents difference between men and women using the student's t -test.

30 years. The CLS enrolled pregnant women between 1979 and 1984 who lived in neighborhoods with historically high levels of childhood lead exposure. Women were excluded if they were known to be addicted to drugs, diabetic or had any known neurological or psychiatric disease. Infants were excluded if their birth weight was less than 1500 g or if genetic or other serious medical issues were present at birth (Dietrich et al., 1987). This process netted newborns that were followed up quarterly through 5 years of age, semiannually from 5 to 6.5 years of age, again at age 10 years and between the ages of 15 and 17 years. A total of 157 CLS participants between the ages of 19 and 24 years provided informed consent and participated in this imaging study (Table 1). Some CLS participants in this imaging study did not have complete lead exposure histories; rather than try to impute the missing values these subjects were excluded from analysis of the years for which there was no lead exposure record. A summary of the cohort size and lead level by age of the participants is shown in Table 2.

2.2. Imaging analysis

We acquired whole-brain, three-dimensional, high resolution volumetric 1.5 T MR data (General Electric Medical Systems, Milwaukee, WI, Signa LX EXCITE scanner operating at software platforms of 11.0 and 12.0) using a T1-weighted, axial inversion recovery preppped, fast spoiled gradient echo (3D IR FSPGR) sequence (echo time (TE) of 5 ms, repetition time (TR) of 12 ms, inversion time (TI) 300 ms, field of view (FOV) = $24 \text{ cm} \times 19.2 \text{ cm}$, 1.5-mm thick contiguous slices in a $256 \times 192 \times 124$ matrix for a resolution of $0.94 \text{ mm} \times 1 \text{ mm} \times 1.5 \text{ mm}$) to assess global and regional changes in brain tissue (gray matter, white matter, and

cerebrospinal fluid [CSF]) volume for comparison with the yearly mean of childhood blood lead concentrations (measured in $\mu\text{g/dL}$) collected between 3 and 78 months of life using voxel based morphometry (VBM) (Ashburner and Friston, 2000). VBM requires normalizing individual structural MRI scans to a study-specific template to allow voxel-by-voxel comparisons between individuals. This approach allows for statistical analyses throughout the brain without a *a priori* designation of structures of interest or manual delineation of brain structures.

2.3. Blood lead concentrations

Blood lead samples were collected and analyzed for lead by anodic stripping voltammetry as been previously described in extensive detail (Dietrich et al., 1993b, 1987; Roda et al., 1988) at the Hematology and Environmental Chemistry Laboratory in the University of Cincinnati Department of Environmental Health. This laboratory was fully accredited to carry out this work and served as a reference laboratory for several blood lead assessment programs throughout the United States. Blood lead concentrations were measured in this cohort every 3 months from birth for the first 5 years of life and every 6 months from 5 to 6.5 years. To investigate the influence of lead exposure at different ages, yearly mean blood lead levels were calculated for all individuals in this study. The mean of all blood lead levels in the preceding year was used to calculate the yearly mean blood lead level. For example, the mean of blood lead levels recorded at birth through 12 months was designated year 1 mean blood lead level. Similarly, the mean of blood lead levels from 15 to 24 months gave the year 2 mean blood lead level, and so on for years 3 through 5. In year 6, blood lead

Table 2

Annual characteristics of the Cincinnati Lead Study.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Mean years 1–6
Cohort							
Number	157	157	156	156	153	149	157
Mean Pb level	10.6 ± 5.4	17.2 ± 8.5	16.3 ± 7.7	14 ± 6.8	11.8 ± 5.9	9.6 ± 5.2	13.3 ± 5.9
Pb level range	3.1–35	5.7–49.3	4.3–50.3	3.1–45.2	3.3–38.3	2.4–32.7	4.7–37.2
Men							
Number	83	83	82	82	79	77	83
Mean Pb level	10.8 ± 5.8	17.7 ± 9.2	16.4 ± 8.1	14 ± 6.9	11.8 ± 6	10.1 ± 5.4	13.5 ± 6.3
Pb level range	3.1–35	5.4–47.8	4.3–43.8	3.1–38.2	3.3–31.8	2.4–24.3	4.7–34.8
Women							
Number	74	74	74	74	74	72	74
Mean Pb level	10.3 ± 4.8	16.7 ± 7.8	16.2 ± 7.3	14 ± 6.8	11.8 ± 5.9	9.2 ± 5.0	13.1 ± 5.5
Pb level range	3.9–23.5	6.4–49.3	4.3–50.3	3.9–45.5	3.3–38.8	3.5–32.7	4.8–37.2

Note: The yearly mean blood lead levels were not significantly different between men and women, men and the combined cohort, or women and the whole cohort (data not shown).

Table 3

Number of voxels within significant gray matter clusters associated with mean childhood blood lead.

Year	Population	All	Frontal	Temporal	Parietal	Cerebellar
1	Group	855	0	0	855	0
	Men	5334	842	0	0	0
	Women	0	0	0	0	0
2	Group	0	0	0	0	0
	Men	5202	2502	0	0	0
	Women	0	0	0	0	0
3	Group	26,304	14,151	871	938	1944
	Men	34,279	22,788	1246	4898	1246
	Women	0	0	0	0	0
4	Group	34,253	22,913	0	5746	1557
	Men	86,815	74,836	1026	5203	872
	Women	0	0	0	0	0
5	Group	41,116	29,538	0	5949	5629
	Men	91,692	89,867	0	812	0
	Women	2992	0	0	0	0
6	Group	68,028	44,207	0	10,978	12,843
	Men	84,784	78,956	0	1982	0
	Women	22,770	0	1791	0	2101

levels were collected semiannually, and the mean of the 66 and 72-month blood lead levels was used to calculate the year 6 mean blood lead level. Maximum values were also noted for each individual, and associations between individual maximum lead levels and adult gray and white matter volumes were also investigated.

2.4. VBM approach

Separate multiple regression models were developed to investigate associations between each yearly mean blood lead level on changes in volume for white matter, gray matter, or cerebrospinal fluid. All initial exploratory analyses were 2-tailed for positive or negative associations, representing volume gain or loss, between yearly mean lead levels and volume in all tissue classes.

Because multiple environmental and developmental factors could influence adult brain volumes, we considered several potential covariates for inclusion in the final regression models. Covariate selection was performed using a modified version of our method reported previously (Cecil et al., 2008). In summary, a simple regression analysis between blood lead level and gray matter volume was used to identify regions where mean blood lead level was associated with gray matter volume change ($p \leq 0.001$ unadjusted, 700 voxel minimum cluster size). After performing simple regressions, possible covariates were then added individually to the otherwise simple regression model. The change in the regression coefficient (beta 1) was calculated on voxel-by-voxel basis. Covariates were retained if the addition of the potential covariate caused a change of more than 10% in beta 1 in more than 20% of the voxels where a significant association was found in the simple regression between mean childhood blood lead and volume change. This process was repeated in a stepwise fashion until no further covariates met the inclusion criteria. This method is similar to that reported previously (Cecil et al., 2008), but uses a stepwise, rather than single-step, selection of covariates.

Covariates considered included participant age at time of imaging, current marijuana use (obtained from a urine drug screening collected at time of imaging), sex, birth weight, gestational age at birth, maternal IQ (Silverstein, 1985) maternal alcohol consumption during pregnancy, maternal marijuana use during pregnancy, maternal tobacco use during pregnancy, mean childhood Hollingshead socioeconomic status (SES) score (Cirino

et al., 2002), current SES score, and HOME Inventory using the mean Home Observation for Measurement of the Environment score measured in early childhood (Bradley and Caldwell, 1979). Two variables—age at time of imaging and birth weight—satisfied these criteria and were included in the final multiple regression models. No significant differences were observed between males and females in the distribution of any of the potential covariates, and separate analyses for each sex were not performed.

2.5. Ethical oversight

The institutional review boards of the Cincinnati Children's Hospital Medical Center and the University of Cincinnati approved the study protocol. A Certificate of Confidentiality for the study was obtained from the National Institutes of Health.

3. Results

We investigated the effects of yearly mean blood lead from 1 to 6 years of age on adult gray matter volume in a voxel-wise analysis of high resolution volumetric MR images (Table 3). We found that later ages of blood lead assessment were more strongly associated with gray matter volume loss than earlier ages of assessment, and that males were more affected than females at all ages (Fig. 1A–C). These findings were most prominent in the frontal lobes. We found the largest regions of gray matter volume loss were in males associated with mean blood lead levels measured during the fifth and sixth year of life (Fig. 1B). Although maximum blood lead measures were recorded at approximately 2 years of age, the strongest associations with adult gray matter volume were observed in association with blood lead levels measured at 5 and 6 years of age (Fig. 1A–C). These results suggest that blood lead measurements obtained early in childhood, mean, or maximum blood lead levels may not fully represent the extent of lead-associated gray matter changes observed in young adults.

4. Discussion

While most developed countries have reduced the major sources of lead exposure in the general population, particularly from the combustion of gasoline (petrol), lead remains a threat to healthy development in children. Lead exposure in US children results primarily from the ingestion of leaded paint residues in

dust and soil, although other sources such as lead in imported toys, art materials, candies, and folk medicines can still present a risk. Blood lead levels during childhood usually correspond to the intensity of normal hand-to-mouth and ambulatory behavior, and peak at approximately 2 years of age (Ris et al., 2004). Blood lead concentrations decline in older children as they grow out of their mouthing behaviors and absorption is diminished, but there is still ongoing exposure that reflects ingestion, environmental exposure, and resorption from mineral deposits in the body throughout life.

4.1. Maximum blood lead levels

Until only recently, it was widely believed that that neurocognitive and behavioral changes in children were latent effects of peak lead exposure occurring years earlier (Bellinger et al., 1992; Pocock et al., 1994; Schwartz, 1994). Several recent studies utilizing serial blood lead measurements have observed that maximum blood lead levels were not strong predictors of all lead-associated findings (Chen et al., 2005; Tong et al., 1996, 1998), and that blood lead levels recorded later in childhood yielded stronger associations between cognitive (Baghurst et al., 1992; Bellinger et al., 1992; Chen et al., 2007, 2005; Factor-Litvak et al., 1999;

Lanphear et al., 2005; Schnaas et al., 2000; Tong et al., 1996, 1998; Wasserman et al., 1997) and behavioral (Burns et al., 1999; Ris et al., 2004) outcomes. Comparing the effects of earlier versus later blood lead concentrations on IQ, Hornung et al. (2009) found that the greatest global cognitive deficits were observed among Cincinnati and Rochester children whose blood lead concentrations continued to rise from 2 to 6 years of age. Furthermore, adult criminal arrest rates in the Cincinnati cohort were a 3.35 times higher in subjects whose 6-year blood lead level was 50% higher than their 2-year blood lead (Hornung et al., 2009).

Our findings are consistent with the cognitive and behavioral studies by demonstrating a stronger and more widespread association for blood lead levels in years 5 and 6 of life when compared with the maximal or early childhood blood lead levels (Fig. 1A and B). However, it is noteworthy that the maximum blood lead level did demonstrate a relationship with volume loss in the frontal lobes.

4.2. Sex differences in lead exposure outcomes

We have previously found that associations between mean childhood blood lead level and gray matter volume loss were much

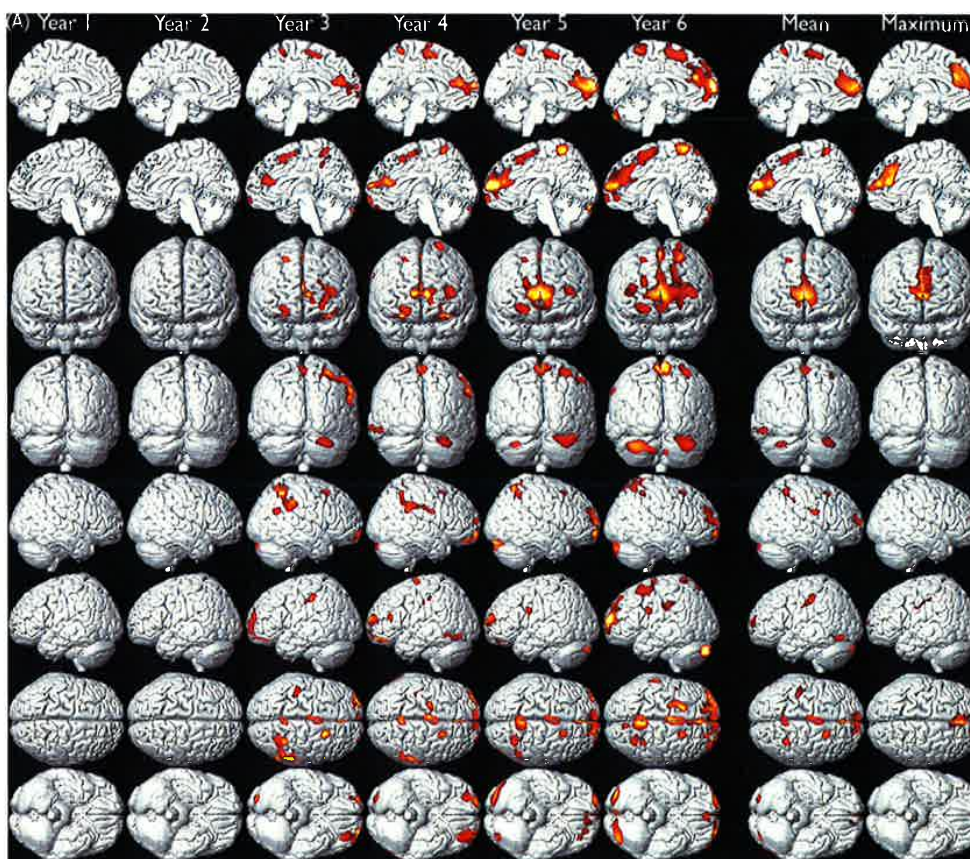


Fig. 1. (A) Gray matter volume loss associated with adjusted yearly mean, childhood mean and maximum blood lead levels in the whole CLS cohort. Hotter colors indicate greater strength of association between blood lead level (annual, mean and maximum of childhood) and gray matter volume loss upon adjustment for age at imaging and birth weight. Significance thresholds were set at uncorrected $p < 0.001$ and 700 voxel minimum contiguous cluster size. (B) Gray matter volume loss associated with adjusted yearly mean, childhood mean and maximum blood lead levels in the males of CLS cohort. Hotter colors indicate greater strength of association between blood lead level (annual, mean and maximum of childhood) and gray matter volume loss in males upon adjustment for age at time of imaging and birth weight. Significance thresholds were set at uncorrected $p < 0.001$ and 700 voxel minimum contiguous cluster size. (C) Gray matter volume loss associated with adjusted yearly mean, childhood mean and maximum blood lead levels in the females of CLS cohort. Hotter colors indicate greater strength of association between blood lead level (year 5, year 6, mean and maximum of childhood) and gray matter volume loss in females upon adjustment for age at time of imaging and birth weight. Significance thresholds were set at uncorrected $p < 0.001$ and 700 voxel minimum contiguous cluster size. No significant findings for years 1–4.

more widespread and significant in males than females despite comparable mean childhood blood lead levels (Cecil et al., 2008). Our previous study was the first to observe sex differences in a radiologic outcome of childhood lead exposure. Several studies, including many performed in this cohort, have observed stronger associations between lead levels in males than females by diverse neurocognitive (Bellinger et al., 1990; Cecil et al., 2008; Dietrich et al., 1987; Froehlich et al., 2007; Pocock et al., 1987; Ris et al., 2004) and behavioral (Wright et al., 2008) outcomes, though these findings are not universal (Baghurst et al., 1992; Rabinowitz et al., 1991; Tong et al., 1996). The consistency of findings of greater lead-associated neurocognitive and behavioral findings in males, and our prior work showing greater extent and significance of lead-associated gray matter volume loss in males, suggests an underlying physiologic difference in how the brains of men and women respond to childhood lead exposure.

4.3. Sex differences and developmental trajectories

Men and women have brains of different sizes, and different trajectories of gray matter maturation. White matter volume increases in a closely linear fashion from birth to early adulthood (Giedd et al., 1999; Lenroot et al., 2007), reflecting consistently increasing myelination with age (Gulani et al., 2001; Hildebrand and Waxman, 1984; Partridge et al., 2004; Suzuki et al., 2003), while total gray matter volume increases in a non-linear and region-specific manner (Giedd, 2004; Giedd et al., 1999; Lenroot and Giedd, 2006; Lenroot et al., 2007; Shaw et al., 2008). Total gray

matter volume peaks at approximately 11 years of age in boys and 9 years of age in girls (Lenroot et al., 2007). Frontal and parietal gray matter volumes peak at approximately 12 years of age in boys and 10 years of age in girls (Giedd et al., 1999; Lenroot et al., 2007). Peaks in gray matter volume are thought to correspond to maximum neuronal number and synaptic density, and the subsequent decline to arise from normal pruning of synapses and neurons (Huttenlocher, 1984; Low and Cheng, 2006). While the rate of volume change is comparable between boys and girls in most regions (Giedd et al., 1999; Lenroot et al., 2007), normal gray matter volume loss occurs at a faster rate in the frontal lobes of boys than girls (De Bellis et al., 2001; Giedd et al., 1999), though this finding has not been consistently replicated (Giedd, 2004; Lenroot et al., 2007).

The different trajectories of gray matter volume change in males and females suggest different windows of neuronal vulnerability during development. Lead has been shown to be neurotoxic to cultures of developing neurons (Basha et al., 2003; Chetty et al., 2001; Reddy and Zawia, 2000), but whether the toxicity of lead varies along the course of neuronal development is unknown. If lead-associated gray matter volume loss results from lead acting during a window of developmental neuronal vulnerability, we would expect to see roughly parallel, chronologically offset patterns of gray matter volume loss in males and females, corresponding roughly to the parallel trajectories of developmental gray matter volume change. Instead, we observed widespread regions of lead-associated gray matter volume loss in males at several time points and an almost complete lack of findings in

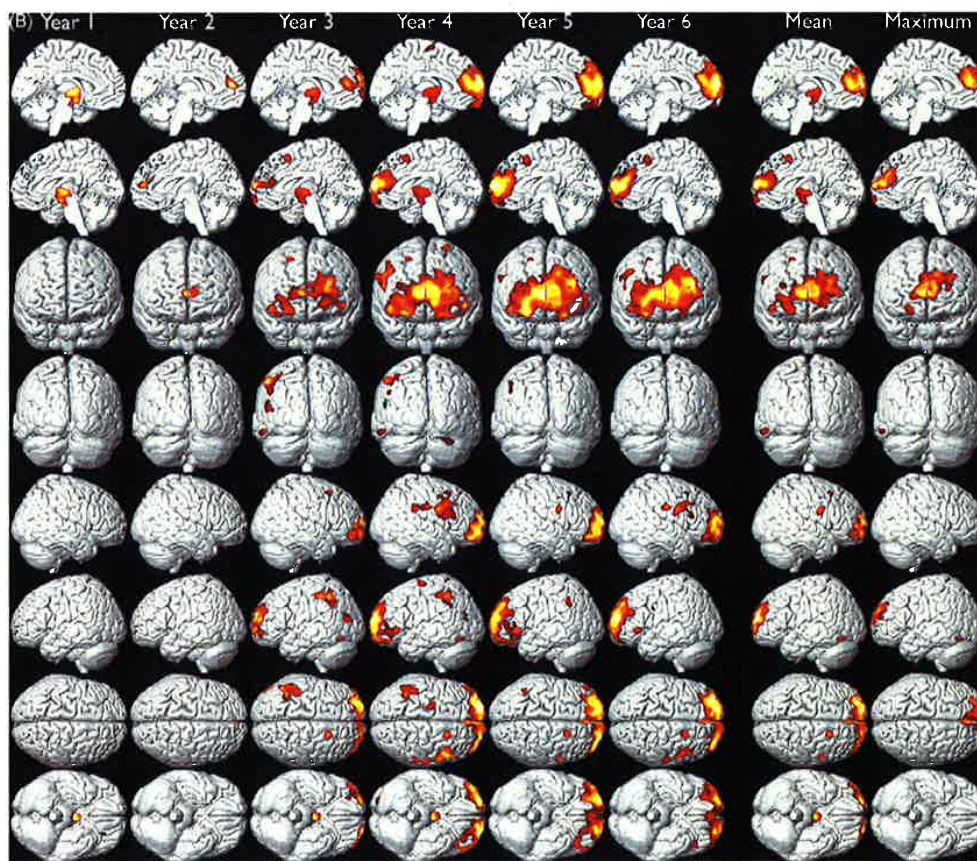


Fig. 1. (Continued).

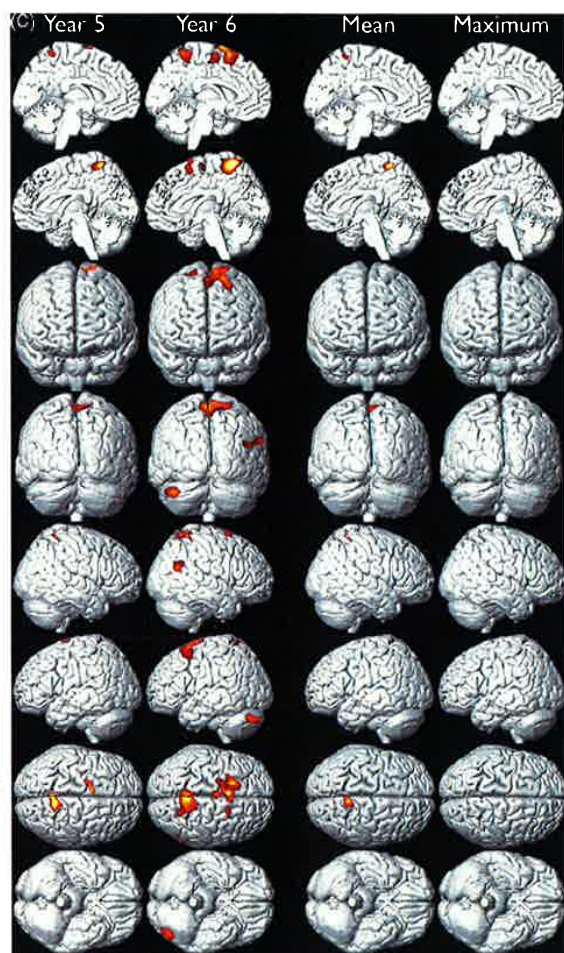


Fig. 1. (Continued).

females. These results suggest males are intrinsically vulnerable, or females are intrinsically protected, from lead-associated gray matter volume loss. Female sex has been shown to be protective in epidemiologic studies of stroke, schizophrenia, and Parkinson's disease (Amantea et al., 2005). If the observed differences in male and female lead-associated gray matter volume loss are due to different physiology, estrogens may explain why the brains of men and women respond differently to similar lead exposures.

4.4. Sex differences and estradiol

Males and females have dramatically different circulating levels of sex hormones throughout life; prepubertal estradiol is approximately 8-fold higher in girls than boys (Cutler, 1997) and 25-fold higher during puberty (Ducharme et al., 1976). Estradiol enhances cell proliferation (Tanapat et al., 1999) and neuronal density (Gould et al., 1990; Hao et al., 2006; Morrison and Hof, 2007; Pozzo-Miller et al., 1999; Tang et al., 2004) and synaptic density (Woolley et al., 1996). Multiple studies have shown that estradiol protects neurons from oxidative stress (Green and Simpkins, 2000; Kolsch et al., 2001; Schmidt et al., 2002; Teepker et al., 2003; Vedder et al., 1999; Wang et al., 2001). The mechanisms of neuroprotective actions of estradiol include activation of the mitogen activated kinase pathway, altered

expression of anti-apoptotic bcl-2 genes, maintenance of calcium homeostasis via the NMDA channel, and direct antioxidative action (Green and Simpkins, 2000; Kolsch et al., 2001; Rao and Kolsch, 2003; Schmidt et al., 2002; Teepker et al., 2003; Vedder et al., 1999; Wang et al., 2001).

In a neuronal culture model, lead-exposed neurons pretreated with estradiol showed reduced expression of the antioxidant glutathione, reduced expression of the pro-apoptotic protein caspase-3, and decreases in the number of apoptotic neurons (Chetty et al., 2007). The neuroprotective properties of estrogens (Amantea et al., 2005; Rao and Kolsch, 2003), particularly estradiol (Chetty et al., 2007), provide a potential etiology for the observed neuroanatomical differences between males and females exposed to comparable levels of lead during childhood.

5. Study limitations

A single blood lead measurement reflects both recent exposure and the ongoing resorption of lead from deep physiological depots such as bone. Individual serial blood lead measurements show that individual variability decreases with age (Mushak, 1998), a finding replicated in this cohort, resulting in a stabilization of rank order of lead exposure over time (Ris et al., 2004). This stabilization of rank order should result in stronger associations between lead levels and lead-associated outcomes with age, making it difficult to determine the extent to which studies such as this one and others (Chen et al., 2007, 2005; Lanphear et al., 2005; McMichael et al., 1988; Song et al., 2003) reflect the decreased variability of blood lead over time.

Our study benefits from a large sample size and detailed histories of lead exposures and perinatal, environmental and sociohereditary influences on development. This study is limited by relatively high mean blood lead concentrations at enrollment and limited generalizability due to the primarily African-American, urban, and impoverished demographics of this cohort (Chen et al., 2007; Ris et al., 2004; Wright et al., 2008). This study utilized a cross-sectional sample of volumetric magnetic resonance images obtained during adulthood as outcome measures. While this outcome measure allows for separation of concurrent from earlier developmental effects of lead exposure, a longitudinal volumetric MRI study of lead exposure during childhood and adolescence would be helpful in delineating effects of lead exposure at different ages on developing brain structures. At the time this study was designed, such an experiment was not technically feasible. While these results reflect altered neuroanatomy associated with lead exposure, the functional consequences of gray matter volume loss, or gain, are often difficult to interpret (Giedd, 2004; Gogtay et al., 2004; Lenroot and Giedd, 2006; Shaw et al., 2008). This problem is compounded when attempting to explain differences in cognitive outcome measures, such as IQ, which utilize widespread, non-distinct brain regions (Haier et al., 2004). More studies are necessary to fully understand the connections between neuro-cognitive and behavioral outcomes and the neuroanatomic findings described herein.

Conflict of interest

None.

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EXHIBIT 2

Flint Residential Testing Report - results collected July 1, 2016 through December 15, 2016

Sample Number	Date Submitted	Analysis (Lead)	2 Bottle Kit			1 Bottle Kit	Analysis (Copper)	2 Bottle Kit			1 Bottle Kit	Street #	Street Name	City	Zip Code
			250 ml Bottle (PPB)	750 ml Bottle (PPB)	1 Liter Calculated (PPB)	1 Liter (PPB)		250 ml Bottle (PPB)	750 ml Bottle (PPB)	1 Liter Calculated (PPB)	1 Liter (PPB)				
LG59599	7/14/2016	Lead				0	Copper				0	2915	HILLCREST AVE	FLINT	48503
LG74244	9/15/2016	Lead				1	Copper				0	6514	HILLCREST DR	FLINT	48506
LG68010	8/18/2016	Lead				0	Copper				0	2002	HILLS ST	FLINT	48503
LG88671	11/28/2016	Lead	2	2	2		Copper	110	120	120		2020	HILLS ST	FLINT	48532
LG88672	11/28/2016	Lead	3	2	2		Copper	60	50	50		2020	HILLS ST	FLINT	48532
LG61942	7/25/2016	Lead				595	Copper				440	2020	HILLS ST	FLINT	48506
LG66301	8/11/2016	Lead				1	Copper				0	2025	HILLS ST	FLINT	48507
LG59565	7/14/2016	Lead				0	Copper				0	2032	HILLS ST	FLINT	48504
LG59624	7/14/2016	Lead				0	Copper				0	2125	HILLS ST	FLINT	48504
LG59632	7/14/2016	Lead				0	Copper				0	2125	HILLS ST	FLINT	48503
LG64582	8/4/2016	Lead				0	Copper				0	2125	HILLS ST	FLINT	48504
LG72140	9/8/2016	Lead				0	Copper				0	2125	HILLS ST	FLINT	48507
LG72145	9/8/2016	Lead				0	Copper				0	2125	HILLS ST	FLINT	48507
LG81087	10/10/2016	Lead				0	Copper				0	2125	HILLS ST	FLINT	48504
LG81089	10/10/2016	Lead				0	Copper				0	2125	HILLS ST	FLINT	48502
LG64581	8/4/2016	Lead				5	Copper				0	2125	HILLS ST	FLINT	48506
LG59627	7/14/2016	Lead				6	Copper				0	2125	HILLS ST	FLINT	48503
LG81088	10/10/2016	Lead				6	Copper				0	2125	HILLS ST	FLINT	48503
LG72143	9/8/2016	Lead				41	Copper				70	2125	HILLS ST	FLINT	48504
LG84544	10/31/2016	Lead	0	0	0		Copper	60	0	0		2207	HILLS ST	FLINT	48507
LG84516	10/31/2016	Lead				0	Copper				310	2219	HILLS ST	FLINT	48506
LG60679	7/19/2016	Lead				5	Copper				130	2401	HILLS ST	FLINT	48506
LG87433	11/17/2016	Lead				7	Copper				140	2401	HILLS ST	FLINT	48507
LG75312	9/21/2016	Lead				16	Copper				130	2401	HILLS ST	FLINT	48504
LG67873	8/18/2016	Lead				22	Copper				180	2401	HILLS ST	FLINT	48505
LG74865	9/19/2016	Lead				0	Copper				0	2409	HILLS ST	FLINT	48506
LG83023	10/20/2016	Lead				0	Copper				0	2409	HILLS ST	FLINT	48505
LG72820	9/12/2016	Lead				0	Copper				0	2409	HILLS ST	FLINT	48506
LG72823	9/12/2016	Lead				0	Copper				360	2409	HILLS ST	FLINT	48502
LG72829	9/12/2016	Lead				0	Copper				0	2409	HILLS ST	FLINT	48504
LG57969	7/7/2016	Lead				2	Copper				0	2409	HILLS ST	FLINT	48502
LG57992	7/7/2016	Lead				18	Copper				50	2409	HILLS ST	FLINT	48506
LG76331	9/22/2016	Lead				0	Copper				0	2410	HILLS ST	FLINT	48503
LG67883	8/18/2016	Lead				69	Copper				110	2410	HILLS ST	FLINT	48503
LG61490	7/21/2016	Lead				0	Copper				310	2418	HILLS ST	FLINT	48504
LG88736	11/28/2016	Lead	0	0	0		Copper	90	0	0		2418	HILLS ST	FLINT	48503
LG76086	9/22/2016	Lead				3	Copper				150	2501	HILLS ST	FLINT	48506
LG88150	11/21/2016	Lead				3	Copper				80	2501	HILLS ST	FLINT	48503
LG60683	7/19/2016	Lead				12	Copper				60	2501	HILLS ST	FLINT	48503
LG68447	8/22/2016	Lead				14	Copper				0	2501	HILLS ST	FLINT	48504
LG64580	8/4/2016	Lead				0	Copper				0	2515	HILLS ST	FLINT	48505
LG88145	11/21/2016	Lead				0	Copper				0	2409	HILLS STREET	FLINT	48503
LG64997	8/8/2016	Lead				0	Copper				0	217	HILLVIEW TER	FENTON	48505
LG60203	7/18/2016	Lead				6	Copper				0	2225	HOFF ST	FLINT	48505
LG67938	8/18/2016	Lead				0	Copper				0	3402	HOGARTH AVE	FLINT	48507
LG75396	9/21/2016	Lead				0	Copper				0	3402	HOGARTH AVE	FLINT	48506
LG60602	7/19/2016	Lead				9	Copper				0	3402	HOGARTH AVE	FLINT	48504
LG88148	11/21/2016	Lead				295	Copper				0	3402	HOGARTH AVE	FLINT	48507
LG75400	9/21/2016	Lead				0	Copper				0	3414	HOGARTH AVE	FLINT	48507
LG87421	11/17/2016	Lead				0	Copper				0	3414	HOGARTH AVE	FLINT	48507
LG67884	8/18/2016	Lead				1	Copper				0	3414	HOGARTH AVE	FLINT	48502
LG60606	7/19/2016	Lead				2	Copper				0	3414	HOGARTH AVE	FLINT	48502

Sample Number	Date Submitted	Analysis (Lead)	2 Bottle Kit			1 Bottle Kit	Analysis (Copper)	2 Bottle Kit			1 Bottle Kit	Street #	Street Name	City	Zip Code
			250 ml Bottle (PPB)	750 ml Bottle (PPB)	1 Liter Calculated (PPB)	1 Liter (PPB)		250 ml Bottle (PPB)	750 ml Bottle (PPB)	1 Liter Calculated (PPB)	1 Liter (PPB)				
LG66295	8/11/2016	Lead				0	Copper				0	1002	S SAGINAW ST	FLINT	48503
LG66298	8/11/2016	Lead				0	Copper				90	1002	S SAGINAW ST	FLINT	48529
LG66299	8/11/2016	Lead				0	Copper				0	1002	S SAGINAW ST	FLINT	48503
LG66304	8/11/2016	Lead				0	Copper				0	1002	S SAGINAW ST	FLINT	48507
LG68015	8/18/2016	Lead				0	Copper				0	1002	S SAGINAW ST	FLINT	48430
LG68017	8/18/2016	Lead				0	Copper				0	1002	S SAGINAW ST	FLINT	48503
LG68018	8/18/2016	Lead				0	Copper				0	1002	S SAGINAW ST	FLINT	48504
LG71359	9/6/2016	Lead				0	Copper				0	1002	S SAGINAW ST	FLINT	48502
LG71362	9/6/2016	Lead				0	Copper				0	1002	S SAGINAW ST	FLINT	48507
LG71363	9/6/2016	Lead				0	Copper				0	1002	S SAGINAW ST	FLINT	48506
LG88131	11/21/2016	Lead				0	Copper				0	1002	S SAGINAW ST	FLINT	48502
LG88132	11/21/2016	Lead				0	Copper				0	1002	S SAGINAW ST	FLINT	48506
LG88133	11/21/2016	Lead				0	Copper				0	1002	S SAGINAW ST	FLINT	48506
LG88135	11/21/2016	Lead				0	Copper				0	1002	S SAGINAW ST	FLINT	48503
LG92060	12/15/2016	Lead				0	Copper				0	1002	S SAGINAW ST	FLINT	48503
LG92061	12/15/2016	Lead				0	Copper				0	1002	S SAGINAW ST	FLINT	48504
LG92062	12/15/2016	Lead				0	Copper				0	1002	S SAGINAW ST	FLINT	48504
LG92063	12/15/2016	Lead				0	Copper				0	1002	S SAGINAW ST	FLINT	48506
LG92064	12/15/2016	Lead				0	Copper				0	1002	S SAGINAW ST	FLINT	48503
LG63009	7/28/2016	Lead				1	Copper				0	1002	S SAGINAW ST	FLINT	48503
LG66296	8/11/2016	Lead				1	Copper				0	1002	S SAGINAW ST	FLINT	48503
LG68016	8/18/2016	Lead				1	Copper				80	1002	S SAGINAW ST	FLINT	48507
LG68019	8/18/2016	Lead				1	Copper				0	1002	S SAGINAW ST	FLINT	48503
LG88134	11/21/2016	Lead				1	Copper				0	1002	S SAGINAW ST	FLINT	48507
LG71361	9/6/2016	Lead				3	Copper				0	1002	S SAGINAW ST	FLINT	48504-3357
LG84157	10/27/2016	Lead				8	Copper				60	1002	S SAGINAW ST	FLINT	48505
LG63014	7/28/2016	Lead				14	Copper				80	1002	S SAGINAW ST	FLINT	48504
LG81770	10/13/2016	Lead				44	Copper				200	1002	S SAGINAW ST	FLINT	48502
LG71360	9/6/2016	Lead				53	Copper				210	1002	S SAGINAW ST	FLINT	48503
LG78690	9/29/2016	Lead				94	Copper				180	1002	S SAGINAW ST	FLINT	48507
LG90790	12/8/2016	Lead				1	Copper				100	4509	S SAGINAW ST	FLINT	48503
LG89848	12/5/2016	Lead	0	0	0		Copper	260	290	280		3725	S SAGINAW ST SUITE 105	FLINT	48504
LG68460	8/22/2016	Lead				0	Copper				0	630	S SAGINAW/ BREAK ROOM	FLINT	48507
LG68456	8/22/2016	Lead				0	Copper				0	630	S SAGINAW/ CD SINK	FLINT	48506
LG57997	7/7/2016	Lead				0	Copper				0	307	S VERNON AVE	FLINT	48503
LG81113	10/10/2016	Lead				0	Copper				0	609	S VERNON AVE	FLINT	48506
LG91172	12/12/2016	Lead	0	0	0		Copper	70	0	0		108	SAGEBRUSH DR	FLINT	48507
LG85353	11/3/2016	Lead				0	Copper				0	3205	SAGINAW	FLINT	48507
LG85704	11/7/2016	Lead				0	Copper				0	3805	SAGINAW	FLINT	48506
LG86518	11/10/2016	Lead				0	Copper				0	4041	SAGINAW	FLINT	48503
LG83428	10/24/2016	Lead				0	Copper				0	340	SAGINAW ST	FLINT	48502
LG83028	10/20/2016	Lead				0	Copper				0	432	SAGINAW ST	FLINT	48504
LG84171	10/27/2016	Lead				3	Copper				0	448	SAGINAW ST	FLINT	48506
LG83040	10/20/2016	Lead				0	Copper				0	531	SAGINAW ST	FLINT	48506
LG83425	10/24/2016	Lead				0	Copper				80	635	SAGINAW ST	FLINT	48504
LG83032	10/20/2016	Lead				0	Copper				0	711	SAGINAW ST	FLINT	48503
LG90794	12/8/2016	Lead				0	Copper				100	746	SAGINAW ST	FLINT	48505
LG90795	12/8/2016	Lead				0	Copper				60	746	SAGINAW ST	FLINT	48503
LG90797	12/8/2016	Lead				0	Copper				100	746	SAGINAW ST	FLINT	48504
LG90796	12/8/2016	Lead				2	Copper				100	746	SAGINAW ST	FLINT	48503
LG90788	12/8/2016	Lead				14	Copper				170	746	SAGINAW ST	FLINT	48507
LG90792	12/8/2016	Lead				54	Copper				240	746	SAGINAW ST	FLINT	48504

Flint Residential Testing Report - results collected July 1, 2016 through December 15, 2016

Sample Number	Date Submitted	Analysis (Lead)	2 Bottle Kit			1 Bottle Kit	Analysis (Copper)	2 Bottle Kit			1 Bottle Kit	Street #	Street Name	City	Zip Code
			250 ml Bottle (PPB)	750 ml Bottle (PPB)	1 Liter Calculated (PPB)	1 Liter (PPB)		250 ml Bottle (PPB)	750 ml Bottle (PPB)	1 Liter Calculated (PPB)	1 Liter (PPB)				
LG90793	12/8/2016	Lead				2,069	Copper				250	746	SAGINAW ST	FLINT	48502
LG63008	7/28/2016	Lead				0	Copper				0	1002	SAGINAW ST	FLINT	48503
LG89892	12/5/2016	Lead	4				Copper	50				1040	SAGINAW ST	FLINT	48532
LG89893	12/5/2016	Lead	176				Copper	90				1040	SAGINAW ST	FLINT	48507
LG86698	11/14/2016	Lead				0	Copper				0	1410	SAGINAW ST	FLINT	48507
LG85354	11/3/2016	Lead				0	Copper				0	1621	SAGINAW ST	FLINT	48503
LG87677	11/17/2016	Lead				0	Copper				0	1714	SAGINAW ST	FLINT	48507
LG91157	12/12/2016	Lead				0	Copper				0	2408	SAGINAW ST	FLINT	48503
LG84514	10/31/2016	Lead				0	Copper				160	2820	SAGINAW ST	FLINT	48505
LG92039	12/15/2016	Lead				0	Copper				0	3010	SAGINAW ST	FLINT	48503
LG92046	12/15/2016	Lead				2	Copper				0	4108	SAGINAW ST	FLINT	48505
LG92052	12/15/2016	Lead				0	Copper				0	4414	SAGINAW ST	FLINT	48504
LG92054	12/15/2016	Lead				0	Copper				0	4601	SAGINAW ST	FLINT	48503
LG92049	12/15/2016	Lead				0	Copper				130	5201	SAGINAW ST	FLINT	48507
LG92037	12/15/2016	Lead				0	Copper				160	7022	SAGINAW ST	FLINT	48504
LG74224	9/15/2016	Lead				0	Copper				220	615	SAINT CLAIR ST	FLINT	48507
LG89412	12/1/2016	Lead	0	0	0		Copper	110	0	0		955	SALISBURY AVE	FLINT	48503
LG89409	12/1/2016	Lead				0	Copper				0	975	SALISBURY AVE	FLINT	48505
LG89863	12/5/2016	Lead	0	0	0		Copper	0	0	0		975	SALISBURY AVE	FLINT	48451
LG87691	11/17/2016	Lead	1	1	1		Copper	50	60	60		3201	SALISHAN CIR	FLINT	48503
LG58013	7/7/2016	Lead				4	Copper				50	5808	SALLY CT	FLINT	48503
LG60613	7/19/2016	Lead				0	Copper				0	5915	SALLY CT	FLINT	48503
LG67830	8/18/2016	Lead				0	Copper				0	5915	SALLY CT	FLINT	48507
LG75394	9/21/2016	Lead				0	Copper				0	5915	SALLY CT	FLINT	48507
LG87333	11/17/2016	Lead				0	Copper				0	5915	SALLY CT	FLINT	48503
LG74217	9/15/2016	Lead				0	Copper				0	6501	SALLY CT	FLINT	48505
LG80749	10/6/2016	Lead				0	Copper				0	6501	SALLY CT	FLINT	48506
LG58053	7/7/2016	Lead				0	Copper				0	6802	SALLY CT	FLINT	48504
LG74223	9/15/2016	Lead				591	Copper				1,730	6914	SALLY CT	FLINT	48506
LG70036	8/29/2016	Lead				0	Copper				90	1242	SAN JUAN DR	FLINT	48504
LG57998	7/7/2016	Lead				0	Copper				0	2002	SANTA BARBARA DR	FLINT	48504
LG91193	12/12/2016	Lead	110	25	46		Copper	210	0	50		2114	SANTA BARBARA DR	FLINT	48505
LG86703	11/14/2016	Lead	0	0	0		Copper	60	0	0		3402	SANTA CLARA CT	FLINT	48507
LG58047	7/7/2016	Lead				1	Copper				70	921	SCOTT ST	FLINT	48502
LG58048	7/7/2016	Lead				32	Copper				310	929	SCOTT ST	FLINT	48507
LG89419	12/1/2016	Lead	2	2	2		Copper	0	0	0		1624	SEMINOLE ST	FLINT	48504
LG88698	11/28/2016	Lead	4	1	2		Copper	140	160	150		1801	SENECA ST	FLINT	48504
LG88695	11/28/2016	Lead	7	1	3		Copper	150	160	160		1801	SENECA ST	FLINT	48504
LG87684	11/17/2016	Lead	7	8	8		Copper	90	0	0		2422	SENECA ST	FLINT	48503
LG76237	9/22/2016	Lead				21	Copper				50	2422	SENECA ST	FLINT	48503
LG71327	9/6/2016	Lead				39	Copper				70	2422	SENECA ST	FLINT	48503
LG91206	12/12/2016	Lead	0				Copper	0				2441	SENECA ST	FLINT	48505
LG72814	9/12/2016	Lead				2	Copper				120	3902	SENECA ST	FLINT	48503
LG70053	8/29/2016	Lead				2	Copper				0	1835	SEYMOUR ST	FLINT	48507
LG85311	11/3/2016	Lead	0	0	0		Copper	0	0	0		5437	SHAMROCK LN	FLINT	***
LG72789	9/12/2016	Lead				3	Copper				70	326	SHEFFIELD AVE	FLINT	48504
LG84134	10/27/2016	Lead	0	0	0		Copper	0	0	0		321	SHEFFIELD AVE APT272 A	FLINT	48505
LG91189	12/12/2016	Lead	0	0	0		Copper	80	0	0		3706	SHERRY DR	FLINT	48505
LG92059	12/15/2016	Lead				80	Copper				160	716	SIMCOE AVE	FLINT	48504
LG88660	11/28/2016	Lead				0	Copper				0	1014	SIMCOE AVE	FLINT	48502
LG83087	10/20/2016	Lead	0	0	0		Copper	0	0	0		1017	SIMCOE AVE	FLINT	48507
LG70999	9/1/2016	Lead				0	Copper				420	1018	SIMCOE AVE	FLINT	48503

Flint Residential Testing Report - results collected July 1, 2016 through December 15, 2016

Sample Number	Date Submitted	Analysis (Lead)	2 Bottle Kit			1 Bottle Kit	Analysis (Copper)	2 Bottle Kit			1 Bottle Kit	Street #	Street Name	City	Zip Code
			250 ml Bottle (PPB)	750 ml Bottle (PPB)	1 Liter Calculated (PPB)	1 Liter (PPB)		250 ml Bottle (PPB)	750 ml Bottle (PPB)	1 Liter Calculated (PPB)	1 Liter (PPB)				
LG61929	7/25/2016	Lead				0	Copper				0	1025	STOCKTON ST APT 2	FLINT	48506
LG76878	9/26/2016	Lead				9	Copper				0	1413	STONE ST	FLINT	48506
LG60208	7/18/2016	Lead				4	Copper				0	1414	STONE ST	FLINT	48507
LG61935	7/25/2016	Lead				5	Copper				0	1414	STONE ST	FLINT	48503
LG63343	8/1/2016	Lead				0	Copper				120	6488	STONEBROOK LN	FLUSHING	48503
LG84132	10/27/2016	Lead	0	0	0		Copper	50	0	0		2006	STONEY BROOK CT	FLINT	48505
LG84143	10/27/2016	Lead	5	1	2		Copper	140	0	0		2006	STONEY BROOK CT	FLINT	48501
LG63030	7/28/2016	Lead				2	Copper				100	2007	STONEY BROOK CT	FLINT	48504
LG67981	8/18/2016	Lead				0	Copper				50	5706	SUBURBAN CT	FLINT	48506
LG67992	8/18/2016	Lead				0	Copper				50	5706	SUBURBAN CT	FLINT	48505
LG85367	11/3/2016	Lead				0	Copper				70	5706	SUBURBAN CT	FLINT	48507
LG85371	11/3/2016	Lead				0	Copper				60	5706	SUBURBAN CT	FLINT	48507
LG91195	12/12/2016	Lead	0	0	0		Copper	160	60	80		5706	SUBURBAN CT	FLINT	48504
LG91198	12/12/2016	Lead	0	0	0		Copper	140	0	0		5706	SUBURBAN CT	FLINT	48504
LG59597	7/14/2016	Lead				0	Copper				340	4264	SUGAR MAPLE RUN	FLINT	48503
LG65006	8/8/2016	Lead				0	Copper				100	4264	SUGAR MAPLE RUN	FLINT	48502
LG82143	10/17/2016	Lead				0	Copper				0	4264	SUGAR MAPLE RUN	FLINT	48504
LG58862	7/12/2016	Lead				3	Copper				0	1201	SUNCREST DR	FLINT	48505
LG58036	7/7/2016	Lead				2	Copper				0	2206	SUNCREST DR	FLINT	48505
LG61522	7/21/2016	Lead				0	Copper				0	9167	SUNCREST DR	FLINT	48503
LG63026	7/28/2016	Lead				4	Copper				0	9167	SUNCREST DR	FLINT	48504
LG59581	7/14/2016	Lead				0	Copper				0	3759	SUNSET DR	FLINT	48507
LG63357	8/1/2016	Lead				2	Copper				80	5210	SUSAN ST	FLINT	48503
LG58046	7/7/2016	Lead				0	Copper				110	6009	SUSAN ST	FLINT	48503
LG62987	7/28/2016	Lead				2	Copper				0	2718	SWAYZE ST	FLINT	48504
LG57967	7/7/2016	Lead				3	Copper				0	2721	SWAYZE ST	FLINT	48504
LG83090	10/20/2016	Lead	0	0	0		Copper	0	0	0		2721	SWAYZEST ST	FLINT	48503
LG67970	8/18/2016	Lead				10	Copper				0	1434	TACOMA ST	FLINT	48506
LG86706	11/14/2016	Lead	1	0	0		Copper	0	0	0		1844	TEBO ST	FLINT	48505
LG63018	7/28/2016	Lead				0	Copper				0	1901	TEBO ST	FLINT	48504
LG83084	10/20/2016	Lead	0	0	0		Copper	0	0	0		1901	TEBO ST	FLINT	48503
LG89854	12/5/2016	Lead	145	16	48		Copper	790	160	320		422	TENNYSON AVE	FLINT	48504
LG70051	8/29/2016	Lead				32	Copper				60	411	TENTH AVE	FLINT	48507
LG63023	7/28/2016	Lead				0	Copper				0	2715	TERRACE DR	FLINT	48532
LG88156	11/21/2016	Lead	10	0	2		Copper	130	0	0		1923	THOM ST	FLINT	48504
LG57249	7/5/2016	Lead				0	Copper				0	2922	THOM ST	FLINT	48503
LG61931	7/25/2016	Lead				0	Copper				0	3114	THOM ST	FLINT	48505
LG69511	8/25/2016	Lead				0	Copper				0	2464	THOMAS ST	FLINT	48503
LG63348	8/1/2016	Lead				0	Copper				60	2472	THOMAS ST	FLINT	48504
LG61189	7/20/2016	Lead				0	Copper				0	2513	THOMAS ST	FLINT	48532
LG61195	7/20/2016	Lead				0	Copper				0	2521	THOMAS ST	FLINT	48507
LG87788	11/18/2016	Lead				0	Copper				0	2521	THOMAS ST	FLINT	48503
LG67818	8/18/2016	Lead				7	Copper				0	2521	THOMAS ST	FLINT	48503
LG75356	9/21/2016	Lead				8	Copper				0	2521	THOMAS ST	FLINT	48506
LG74855	9/19/2016	Lead				2	Copper				0	2533	THOMAS ST	FLINT	48503
LG58861	7/12/2016	Lead				0	Copper				0	2560	THOMAS ST	FLINT	48503
LG84149	10/27/2016	Lead	1	0	0		Copper	70	0	0		2578	THOMAS ST	FLINT	48506
LG71337	9/6/2016	Lead				0	Copper				0	423	THOMSON ST	FLINT	48506
LG71343	9/6/2016	Lead				2	Copper				0	423	THOMSON ST	FLINT	48504
LG67859	8/18/2016	Lead				0	Copper				0	617	THOMSON ST	FLINT	48504
LG60772	7/20/2016	Lead				3	Copper				80	617	THOMSON ST	FLINT	48503
LG75382	9/21/2016	Lead				68	Copper				50	617	THOMSON ST	FLINT	48504

Sample Number	Date Submitted	Analysis (Lead)	2 Bottle Kit			1 Bottle Kit	Analysis (Copper)	2 Bottle Kit			1 Bottle Kit	Street #	Street Name	City	Zip Code
			250 ml Bottle (PPB)	750 ml Bottle (PPB)	1 Liter Calculated (PPB)	1 Liter (PPB)		250 ml Bottle (PPB)	750 ml Bottle (PPB)	1 Liter Calculated (PPB)	1 Liter (PPB)				
LG87395	11/17/2016	Lead				5.986	Copper				780	617	THOMSON ST	FLINT	48502
LG86534	11/10/2016	Lead	1	0	0		Copper	0	0	0		609	THOMSON ST APT 1	FLINT	48505
LG58011	7/7/2016	Lead				107	Copper				340	1822	TIMBERLANE DR	FLINT	48505
LG88675	11/28/2016	Lead	2	0	0		Copper	180	90	110		2030	TORRANCE ST	FLINT	48503
LG79592	10/3/2016	Lead				4	Copper				0	1835	TOWER ST	FLINT	48503
LG59608	7/14/2016	Lead				0	Copper				0	2608	TROUT DR UNIT #334	FLINT	48504
LG68000	8/18/2016	Lead				0	Copper				0	4109	TRUMBALL AVE	FLINT	48503
LG91173	12/12/2016	Lead	0	0	0		Copper	0	0	0		4311	TRUMBULL AVE	FLINT	48430
LG60205	7/18/2016	Lead				1	Copper				50	1817	TUSCOLA ST	FLINT	48504
LG61529	7/21/2016	Lead				0	Copper				0	4101	TUXEDO AVE	FLINT	48503
LG59573	7/14/2016	Lead				0	Copper				0	4122	TUXEDO AVE	FLINT	48503
LG81096	10/10/2016	Lead				0	Copper				0	2532	TYRONE ST	FLINT	48507
LG61488	7/21/2016	Lead				6	Copper				140	2568	TYRONE ST	FLINT	48506
LG90803	12/8/2016	Lead				0	Copper				300	1518	UNIVERSITY	FLINT	48503
LG69537	8/25/2016	Lead				0	Copper				0	1312	UNIVERSITY AVE	FLINT	48505
LG62975	7/28/2016	Lead				0	Copper				0	1602	UNIVERSITY AVE	FLINT	48532
LG62977	7/28/2016	Lead				0	Copper				0	1602	UNIVERSITY AVE	FLINT	48503
LG71348	9/6/2016	Lead				0	Copper				0	1602	UNIVERSITY AVE	FLINT	48503
LG71349	9/6/2016	Lead				0	Copper				120	1602	UNIVERSITY AVE	FLINT	48507
LG81786	10/13/2016	Lead				0	Copper				0	1602	UNIVERSITY AVE	FLINT	48503
LG81775	10/13/2016	Lead				0	Copper				0	1602	UNIVERSITY AVE	FLINT	48503
LG81779	10/13/2016	Lead				0	Copper				0	1602	UNIVERSITY AVE	FLINT	48503
LG62980	7/28/2016	Lead				1	Copper				60	1602	UNIVERSITY AVE	FLINT	48507
LG71350	9/6/2016	Lead				3	Copper				100	1602	UNIVERSITY AVE	FLINT	48507
LG87992	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48503
LG87993	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48505
LG87994	11/21/2016	Lead	0				Copper	220				1518	UNIVERSITY AVENUE	FLINT	48505
LG87995	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48504
LG87996	11/21/2016	Lead	0				Copper	90				1518	UNIVERSITY AVENUE	FLINT	48503
LG87997	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48504
LG87998	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48507
LG87999	11/21/2016	Lead	0				Copper	70				1518	UNIVERSITY AVENUE	FLINT	48502
LG88000	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48503
LG88001	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48503
LG88002	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48506
LG88003	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48503
LG88004	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48503
LG88005	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48458
LG88006	11/21/2016	Lead	0				Copper	100				1518	UNIVERSITY AVENUE	FLINT	48504
LG88007	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48506
LG88008	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48507
LG88009	11/21/2016	Lead	0				Copper	60				1518	UNIVERSITY AVENUE	FLINT	48503
LG88010	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48505
LG88011	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48503
LG88012	11/21/2016	Lead	0				Copper	60				1518	UNIVERSITY AVENUE	FLINT	48506
LG88013	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48503
LG88014	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48503
LG88015	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48507
LG88016	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48503-3845
LG88017	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48503
LG88018	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48504
LG88019	11/21/2016	Lead	0				Copper	0				1518	UNIVERSITY AVENUE	FLINT	48503

EXHIBIT 3

Sample Number	Date Submitted	Analysis (Lead)	Lead (ppb)	Analysis (Copper)	Copper (ppb)	Street #	Street Name	City	Zip Code
LG31292	4/4/2016	Lead	0	Copper	0	2409	HILLS ST	FLINT	48503
LG35057	4/13/2016	Lead	2	Copper	0	2409	HILLS ST	FLINT	48503
LG42885	5/5/2016	Lead	5	Copper	0	2409	HILLS ST	FLINT	48503
LG14669	2/17/2016	Lead	9	Copper	70	2410	HILLS ST	FLINT	48503
LG17549	2/24/2016	Lead	16	Copper	100	2410	HILLS ST	FLINT	48503
LG19399	3/2/2016	Lead	29	Copper	100	2410	HILLS ST	FLINT	48503
LG23804	3/16/2016	Lead	18	Copper	0	2410	HILLS ST	FLINT	48503
LG25269	3/18/2016	Lead	0	Copper	0	2410	HILLS ST	FLINT	48503
LG29681	3/30/2016	Lead	116	Copper	60	2410	HILLS ST	FLINT	48503
LG32969	4/7/2016	Lead	9	Copper	0	2410	HILLS ST	FLINT	48503
LG35045	4/13/2016	Lead	22	Copper	80	2410	HILLS ST	FLINT	48503
LG38227	4/22/2016	Lead	8	Copper	50	2410	HILLS ST	FLINT	48503
LG47398	5/25/2016	Lead	9	Copper	0	2410	HILLS ST	FLINT	48503
LG10763	2/8/2016	Lead	0	Copper	140	2418	HILLS ST	FLINT	48503
LG22471	3/11/2016	Lead	0	Copper	120	2418	HILLS ST	FLINT	48503
LG42870	5/5/2016	Lead	0	Copper	100	2418	HILLS ST	FLINT	48503
LG13718	2/16/2016	Lead	96	Copper	370	2501	HILLS ST	FLINT	48503
LG23807	3/16/2016	Lead	5	Copper	240	2501	HILLS ST	FLINT	48503
LG29648	3/30/2016	Lead	4	Copper	230	2501	HILLS ST	FLINT	48503
LG35081	4/13/2016	Lead	2	Copper	220	2501	HILLS ST	FLINT	48503
LG47724	5/26/2016	Lead	4	Copper	130	2501	HILLS ST	FLINT	48503
LG54478	6/22/2016	Lead	15	Copper	80	2501	HILLS ST	FLINT	48503
LG02353	1/22/2016	Lead	0	Copper	0	2502	HILLS ST	FLINT	48503
LG17548	2/24/2016	Lead	12	Copper	70	2502	HILLS ST	FLINT	48503
LG19397	3/2/2016	Lead	0	Copper	110	2502	HILLS ST	FLINT	48503
LG23878	3/16/2016	Lead	19	Copper	100	2502	HILLS ST	FLINT	48503
LG29654	3/30/2016	Lead	8	Copper	70	2502	HILLS ST	FLINT	48503
LG35086	4/13/2016	Lead	4	Copper	140	2502	HILLS ST	FLINT	48503
LG06496	1/31/2016	Lead	0	Copper	0	2507	HILLS ST	FLINT	48503
LG04803	1/27/2016	Lead	3	Copper	0	2511	HILLS ST	FLINT	48503
LG08716	2/3/2016	Lead	4	Copper	0	2515	HILLS ST	FLINT	48503
LG35461	4/13/2016	Lead	1	Copper	120	2137	HILLS ST UPPER	FLINT	48503
LG20407	3/4/2016	Lead	8	Copper	330	2137	HILLS ST UPPER #2	FLINT	48503
LG20642	3/5/2016	Lead	0	Copper	0	3290	HILLVIEW AVE	FLINT	48504
LG47367	5/25/2016	Lead	3	Copper	70	258	HOBSON AVE	FLINT	48505
LG13964	2/16/2016	Lead	3	Copper	0	2212	HOFF ST	FLINT	48506
LG04155	1/26/2016	Lead	0	Copper	140	2217	HOFF ST	FLINT	48506
LG09709	2/5/2016	Lead	3	Copper	60	2310	HOFF ST	FLINT	48506
LG03653	1/25/2016	Lead	2	Copper	0	2414	HOFF ST	FLINT	48506
LG18604	2/27/2016	Lead	1	Copper	0	2521	HOFF ST	FLINT	48506
LG09787	2/5/2016	Lead	75	Copper	70	2610	HOFF ST	FLINT	48506
LG42844	5/5/2016	Lead	0	Copper	0	3367	HOGARTH AVE	FLINT	48532
LG06975	2/1/2016	Lead	0	Copper	0	3402	HOGARTH AVE	FLINT	48503
LG18550	2/26/2016	Lead	186	Copper	90	3402	HOGARTH AVE	FLINT	48503
LG20804	3/6/2016	Lead	0	Copper	0	3402	HOGARTH AVE	FLINT	48503
LG24302	3/16/2016	Lead	2	Copper	0	3402	HOGARTH AVE	FLINT	48503
LG29829	3/30/2016	Lead	43	Copper	0	3402	HOGARTH AVE	FLINT	48503
LG35031	4/13/2016	Lead	35	Copper	0	3402	HOGARTH AVE	FLINT	48503
LG47439	5/25/2016	Lead	62	Copper	0	3402	HOGARTH AVE	FLINT	48503
LG54488	6/22/2016	Lead	1	Copper	0	3402	HOGARTH AVE	FLINT	48503
LG05545	1/28/2016	Lead	254	Copper	2,390	3410	HOGARTH AVE	FLINT	48503
LG17682	2/24/2016	Lead	3	Copper	380	3410	HOGARTH AVE	FLINT	48503
LG19714	3/2/2016	Lead	14	Copper	410	3410	HOGARTH AVE	FLINT	48503
LG23953	3/16/2016	Lead	3	Copper	280	3410	HOGARTH AVE	FLINT	48503
LG29797	3/30/2016	Lead	421	Copper	4,970	3410	HOGARTH AVE	FLINT	48503
LG35023	4/13/2016	Lead	2	Copper	210	3410	HOGARTH AVE	FLINT	48503
LG17678	2/24/2016	Lead	4	Copper	0	3414	HOGARTH AVE	FLINT	48503
LG19569	3/2/2016	Lead	0	Copper	0	3414	HOGARTH AVE	FLINT	48503
LG24305	3/16/2016	Lead	1	Copper	0	3414	HOGARTH AVE	FLINT	48503
LG30662	3/31/2016	Lead	1	Copper	0	3414	HOGARTH AVE	FLINT	48503
LG36155	4/15/2016	Lead	1	Copper	0	3414	HOGARTH AVE	FLINT	48503
LG47369	5/25/2016	Lead	1	Copper	0	3414	HOGARTH AVE	FLINT	48503
LG54491	6/22/2016	Lead	2	Copper	0	3414	HOGARTH AVE	FLINT	48503
LG05585	1/28/2016	Lead	2	Copper	0	3418	HOGARTH AVE	FLINT	48503
LG05637	1/28/2016	Lead	36	Copper	190	3513	HOGARTH AVE	FLINT	48503
LG19698	3/2/2016	Lead	43	Copper	220	3513	HOGARTH AVE	FLINT	48503
LG24300	3/16/2016	Lead	28	Copper	180	3513	HOGARTH AVE	FLINT	48503
LG29802	3/30/2016	Lead	19	Copper	150	3513	HOGARTH AVE	FLINT	48503
LG35101	4/13/2016	Lead	31	Copper	180	3513	HOGARTH AVE	FLINT	48503
LG47445	5/25/2016	Lead	3	Copper	100	3513	HOGARTH AVE	FLINT	48503
LG54487	6/22/2016	Lead	6	Copper	90	3513	HOGARTH AVE	FLINT	48503
LG05722	1/28/2016	Lead	4	Copper	50	3618	HOGARTH AVE	FLINT	48532
LG42850	5/5/2016	Lead	135	Copper	340	3622	HOGARTH AVE	FLINT	48532
LG07931	2/2/2016	Lead	0	Copper	50	3625	HOGARTH AVE	FLINT	48532
LG15630	2/18/2016	Lead	0	Copper	60	3625	HOGARTH AVE	FLINT	48532
LG42793	5/5/2016	Lead	0	Copper	0	3705	HOGARTH AVE	FLINT	48532
LG00830	1/20/2016	Lead	0	Copper	0	3714	HOGARTH AVE	FLINT	48532
LG01307	1/21/2016	Lead	1	Copper	0	3722	HOGARTH AVE	FLINT	48532
LG16876	2/23/2016	Lead	0	Copper	60	3806	HOGARTH AVE	FLINT	48532

Sample Number	Date Submitted	Analysis (Lead)	Lead (ppb)	Analysis (Copper)	Copper (ppb)	Street #	Street Name	City	Zip Code
LG05198	1/27/2016	Lead	8	Copper	430	614	S LYNCH ST	FLINT	48503
LG17913	2/24/2016	Lead	7	Copper	360	614	S LYNCH ST	FLINT	48503
LG27425	3/23/2016	Lead	7	Copper	340	614	S LYNCH ST	FLINT	48503
LG38226	4/22/2016	Lead	52	Copper	320	614	S LYNCH ST	FLINT	48503
LG49286	6/2/2016	Lead	3	Copper	120	614	S LYNCH ST	FLINT	48503
LG56030	6/28/2016	Lead	2	Copper	100	614	S LYNCH ST	FLINT	48503
LG00571	1/19/2016	Lead	0	Copper	0	617	S LYNCH ST	FLINT	48503
LG00596	1/19/2016	Lead	0	Copper	0	420	S MEADE ST	FLINT	48503
LG29443	3/29/2016	Lead	67	Copper	510	420	S MEADE ST	FLINT	48503
LG16223	2/20/2016	Lead	3	Copper	60	425	S MEADE ST	FLINT	48503
LG08432	2/3/2016	Lead	0	Copper	0	441	S MEADE ST	FLINT	48503
LG42014	5/3/2016	Lead	2	Copper	0	441	S MEADE ST	FLINT	48503
LG34318	4/11/2016	Lead	0	Copper	60	501	S MEADE ST	FLINT	48503
LG42837	5/5/2016	Lead	355	Copper	6,780	518	S MEADE ST	FLINT	48503
LG01477	1/21/2016	Lead	0	Copper	0	601	S MEADE ST	FLINT	
LG03587	1/25/2016	Lead	0	Copper	0	618	S MEADE ST	FLINT	48503
LG08702	2/3/2016	Lead	2	Copper	0	618	S MEADE ST	FLINT	48503
LG04799	1/27/2016	Lead	0	Copper	0	721	S MEADE ST	FLINT	48503
LG15530	2/18/2016	Lead	0	Copper	0	621	S MEADE ST #5	FLINT	48503
LG16183	2/20/2016	Lead	8	Copper	0	501	S MEADE ST APT 12	FLINT	48503
LG22740	3/12/2016	Lead	0	Copper	130	601	S MEADE ST APT 4	FLINT	48503
LG17024	2/23/2016	Lead	2	Copper	0	501	S MEADE ST APT 5	FLINT	48503
LG35424	4/13/2016	Lead	9	Copper	50	501	S MEADE ST APT 5	FLINT	48503
LG38292	4/22/2016	Lead	0	Copper	60	601	S MEADE ST APT 5	FLINT	48503
LG05231	1/27/2016	Lead	1	Copper	100	601	S MEADE ST APT 6	FLINT	48503
LG56041	6/28/2016	Lead	1	Copper	0	601	S MEADE ST APT 6	FLINT	48503
LG01237	1/21/2016	Lead	5	Copper	0	501	S MEADE ST APT 8	FLINT	48503
LG09839	2/5/2016	Lead	0	Copper	0	521	S MEADE ST APT 8	FLINT	48503
LG16959	2/23/2016	Lead	31	Copper	160	601	S MEADE ST APT E	FLINT	48503
LG07045	2/1/2016	Lead	0	Copper	0	3104	S PARKWAY	FLINT	48504
LG25260	3/18/2016	Lead	6	Copper	160	9648	S PATTEN	DAVISON	48423
LG20480	3/4/2016	Lead	0	Copper	60	408	S SAGINAW ST	FLINT	48502
LG04751	1/27/2016	Lead	0	Copper	290	452	S SAGINAW ST	FLINT	48502
LG42084	5/3/2016	Lead	0	Copper	50	460	S SAGINAW ST	FLINT	48502
LF85958	10/2/2015	Lead	2	Copper	920	540	S SAGINAW ST	FLINT	48502
LF88280	10/20/2015	Lead	0	Copper	190	555	S SAGINAW ST	FLINT	48502
LG13605	2/16/2016	Lead	0	Copper	650	601	S SAGINAW ST	FLINT	48502
LG24371	3/16/2016	Lead	0	Copper	130	601	S SAGINAW ST	FLINT	48503
LG29608	3/30/2016	Lead	0	Copper	80	601	S SAGINAW ST	FLINT	48502
LG35770	4/14/2016	Lead	0	Copper	50	601	S SAGINAW ST	FLINT	48502
LG13992	2/16/2016	Lead	0	Copper	0	625	S SAGINAW ST	FLINT	48502
LF91276	11/9/2015	Lead	5	Copper	120	746	S SAGINAW ST	FLINT	48502
LF99994	1/15/2016	Lead	1	Copper	120	800	S SAGINAW ST	FLINT	48502
LG05715	1/28/2016	Lead	0	Copper	440	816	S SAGINAW ST	FLINT	48502
LG30968	4/1/2016	Lead	0	Copper	400	900	S SAGINAW ST	FLINT	48502
LG42136	5/3/2016	Lead	33	Copper	190	1002	S SAGINAW ST	FLINT	48502
LG42141	5/3/2016	Lead	51	Copper	240	1002	S SAGINAW ST	FLINT	48502
LG42143	5/3/2016	Lead	0	Copper	310	1002	S SAGINAW ST	FLINT	48502
LG42144	5/3/2016	Lead	92	Copper	180	1002	S SAGINAW ST	FLINT	48502
LG42149	5/3/2016	Lead	8	Copper	120	1002	S SAGINAW ST	FLINT	48502
LG04242	1/26/2016	Lead	0	Copper	0	1520	S SAGINAW ST		
LG53241	6/16/2016	Lead	0	Copper	0	1520	S SAGINAW ST	FLINT	48503
LG22433	3/11/2016	Lead	258	Copper	0	1613	S SAGINAW ST	FLINT	48503
LG15464	2/18/2016	Lead	0	Copper	0	1621	S SAGINAW ST	FLINT	48503
LG05015	1/27/2016	Lead	2	Copper	100	2201	S SAGINAW ST	FLINT	48503
LG13398	2/15/2016	Lead	0	Copper	0	2310	S SAGINAW ST	FLINT	48503
LG32220	4/6/2016	Lead	0	Copper	0	2408	S SAGINAW ST	FLINT	48503
LF88278	10/20/2015	Lead	1	Copper	630	2820	S SAGINAW ST	FLINT	48503
LF88283	10/20/2015	Lead	0	Copper	520	2820	S SAGINAW ST	FLINT	48503
LF88288	10/20/2015	Lead	2	Copper	620	2820	S SAGINAW ST	FLINT	48503
LF88291	10/20/2015	Lead	1	Copper	330	2820	S SAGINAW ST	FLINT	48503
LF88293	10/20/2015	Lead	0	Copper	610	2820	S SAGINAW ST	FLINT	48503
LF88297	10/20/2015	Lead	1	Copper	460	2820	S SAGINAW ST	FLINT	48503
LF88302	10/20/2015	Lead	0	Copper	560	2820	S SAGINAW ST	FLINT	48503
LF88303	10/20/2015	Lead	2	Copper	180	2820	S SAGINAW ST	FLINT	48503
LF88308	10/20/2015	Lead	0	Copper	590	2820	S SAGINAW ST	FLINT	48503
LF88309	10/20/2015	Lead	0	Copper	530	2820	S SAGINAW ST	FLINT	48503
LF88310	10/20/2015	Lead	0	Copper	610	2820	S SAGINAW ST	FLINT	48503
LF88312	10/20/2015	Lead	1	Copper	220	2820	S SAGINAW ST	FLINT	48503
LF88313	10/20/2015	Lead	0	Copper	630	2820	S SAGINAW ST	FLINT	48503
LF88315	10/20/2015	Lead	1	Copper	190	2820	S SAGINAW ST	FLINT	48503
LF88316	10/20/2015	Lead	0	Copper	710	2820	S SAGINAW ST	FLINT	48503
LF88317	10/20/2015	Lead	0	Copper	670	2820	S SAGINAW ST	FLINT	48503
LF88318	10/20/2015	Lead	0	Copper	450	2820	S SAGINAW ST	FLINT	48503
LF88319	10/20/2015	Lead	0	Copper	910	2820	S SAGINAW ST	FLINT	48503
LF88321	10/20/2015	Lead	2	Copper	180	2820	S SAGINAW ST	FLINT	48503
LF88323	10/20/2015	Lead	0	Copper	800	2820	S SAGINAW ST	FLINT	48503
LF88325	10/20/2015	Lead	0	Copper	800	2820	S SAGINAW ST	FLINT	48503
LG03143	1/24/2016	Lead	0	Copper	210	2820	S SAGINAW ST	FLINT	48503

Sample Number	Date Submitted	Analysis (Lead)	Lead (ppb)	Analysis (Copper)	Copper (ppb)	Street #	Street Name	City	Zip Code
LG17492	2/24/2016	Lead	30	Copper	60	2521	THOMAS ST	FLINT	48504
LG19554	3/2/2016	Lead	110	Copper	130	2521	THOMAS ST	FLINT	48504
LG24313	3/16/2016	Lead	0	Copper	0	2521	THOMAS ST	FLINT	48503
LG29857	3/30/2016	Lead	34	Copper	50	2521	THOMAS ST	FLINT	48504
LG34950	4/13/2016	Lead	21	Copper	50	2521	THOMAS ST	FLINT	48504
LG47441	5/25/2016	Lead	0	Copper	0	2521	THOMAS ST	FLINT	48504
LG54861	6/22/2016	Lead	8	Copper	0	2521	THOMAS ST	FLINT	48504
LG18024	2/24/2016	Lead	47	Copper	110	2525	THOMAS ST	FLINT	48504
LG18004	2/24/2016	Lead	95	Copper	490	2529	THOMAS ST	FLINT	48504
LG23062	3/13/2016	Lead	2	Copper	0	2529	THOMAS ST	FLINT	48504
LG11249	2/9/2016	Lead	4	Copper	0	2533	THOMAS ST	FLINT	48504
LG06570	1/31/2016	Lead	6	Copper	250	2548	THOMAS ST	FLINT	48504
LG08327	2/3/2016	Lead	6	Copper	0	2560	THOMAS ST	FLINT	48504
LG16980	2/23/2016	Lead	2	Copper	0	2560	THOMAS ST	FLINT	48504
LG20169	3/3/2016	Lead	5	Copper	70	2560	THOMAS ST	FLINT	48504
LG49199	6/2/2016	Lead	3	Copper	60	2560	THOMAS ST	FLINT	48504
LG54315	6/21/2016	Lead	0	Copper	0	2560	THOMAS ST	FLINT	48504
LG20013	3/3/2016	Lead	2	Copper	120	2565	THOMAS ST	FLINT	48504
LG26320	3/20/2016	Lead	137	Copper	1,340	2565	THOMAS ST	FLINT	48504
LG07898	2/2/2016	Lead	3	Copper	210	2569	THOMAS ST	FLINT	48504
LG04607	1/26/2016	Lead	1	Copper	90	2573	THOMAS ST	FLINT	48504
LG38263	4/22/2016	Lead	1	Copper	90	2573	THOMAS ST	FLINT	48504
LG02082	1/21/2016	Lead	0	Copper	70	2578	THOMAS ST	FLINT	48504
LG06763	2/1/2016	Lead	1	Copper	130	2578	THOMAS ST	FLINT	48504
LG41970	5/3/2016	Lead	0	Copper	80	2578	THOMAS ST	FLINT	48504
LG18486	2/26/2016	Lead	7	Copper	160	2581	THOMAS ST	FLINT	48504
LG18459	2/26/2016	Lead	0	Copper	350	2607	THOMAS ST	FLINT	48504
LG04248	1/26/2016	Lead	3	Copper	390	2613	THOMAS ST	FLINT	48504
LG09203	2/4/2016	Lead	10	Copper	130	2625	THOMAS ST	FLINT	48504
LG31029	4/1/2016	Lead	3	Copper	60	2709	THOMAS ST	FLINT	48504
LG09429	2/4/2016	Lead	3	Copper	0	2710	THOMAS ST	FLINT	48504
LG06952	2/1/2016	Lead	2	Copper	0	2718	THOMAS ST	FLINT	
LG53208	6/16/2016	Lead	0	Copper	0	2726	THOMAS ST	FLINT	48504
LG13709	2/16/2016	Lead	7	Copper	0	2729	THOMAS ST	FLINT	48504
LG19438	3/2/2016	Lead	0	Copper	0	2729	THOMAS ST	FLINT	48504
LG23813	3/16/2016	Lead	2	Copper	0	2729	THOMAS ST	FLINT	48504
LG30678	3/31/2016	Lead	2	Copper	0	2729	THOMAS ST	FLINT	48504
LG35754	4/14/2016	Lead	0	Copper	0	2729	THOMAS ST	FLINT	48504
LG04311	1/26/2016	Lead	2	Copper	0	2733	THOMAS ST	FLINT	48054
LG02492	1/22/2016	Lead	3	Copper	130	2737	THOMAS ST	FLINT	48504
LG11309	2/9/2016	Lead	0	Copper	60	2741	THOMAS ST	FLINT	48504
LG30675	3/31/2016	Lead	0	Copper	50	2741	THOMAS ST	FLINT	48504
LG30684	3/31/2016	Lead	0	Copper	0	2741	THOMAS ST	FLINT	48504
LG09737	2/5/2016	Lead	0	Copper	0	2742	THOMAS ST	FLINT	48504
LG09995	2/5/2016	Lead	0	Copper	0	2742	THOMAS ST	FLINT	48504
LG24920	3/17/2016	Lead	0	Copper	0	2746	THOMAS ST	FLINT	48504
LG01283	1/21/2016	Lead	0	Copper	0	2754	THOMAS ST	FLINT	48504
LG26871	3/22/2016	Lead	0	Copper	0	2762	THOMAS ST	FLINT	48504
LG31013	4/1/2016	Lead	0	Copper	0	2762	THOMAS ST	FLINT	48504
LG06930	2/1/2016	Lead	0	Copper	60	2801	THOMAS ST	FLINT	48504
LF94275	12/2/2015	Lead	1	Copper	100	2806	THOMAS ST	FLINT	48504
LG17686	2/24/2016	Lead	2	Copper	0	2807	THOMAS ST	FLINT	48504
LG19424	3/2/2016	Lead	0	Copper	0	2807	THOMAS ST	FLINT	48504
LG03617	1/25/2016	Lead	0	Copper	0	423	THOMSON ST	FLINT	48503
LG16322	2/21/2016	Lead	4	Copper	100	504	THOMSON ST	FLINT	48503
LG43215	5/9/2016	Lead	3	Copper	90	617	THOMSON ST	FLINT	48503
LG47403	5/25/2016	Lead	2	Copper	90	617	THOMSON ST	FLINT	48503
LG54840	6/22/2016	Lead	24	Copper	140	617	THOMSON ST	FLINT	48503
LG25258	3/18/2016	Lead	1	Copper	0	624	THOMSON ST	FLINT	48503
LG08471	2/3/2016	Lead	1	Copper	50	713	THOMSON ST	FLINT	48503
LG06299	1/30/2016	Lead	25	Copper	90	714	THOMSON ST	FLINT	48503
LG03759	1/25/2016	Lead	1	Copper	0	725	THOMSON ST	FLINT	48503
LG08635	2/3/2016	Lead	0	Copper	0	725	THOMSON ST	FLINT	48503
LG02054	1/21/2016	Lead	1	Copper	0	729	THOMSON ST	FLINT	48503
LG03819	1/25/2016	Lead	2	Copper	0	729	THOMSON ST	FLINT	48503
LG03018	1/24/2016	Lead	0	Copper	0	735	THOMSON ST	FLINT	48503
LG03757	1/25/2016	Lead	1,490	Copper	60	735	THOMSON ST	FLINT	48503
LG18456	2/26/2016	Lead	1	Copper	190	801	THOMSON ST	FLINT	48503
LG10657	2/8/2016	Lead	1	Copper	0	806	THOMSON ST	FLINT	48503
LG08406	2/3/2016	Lead	0	Copper	0	702	THOMSON ST #1	FLINT	48503
LG07877	2/2/2016	Lead	0	Copper	0	510	THOMSON ST #1-C	FLINT	48503
LG08803	2/3/2016	Lead	0	Copper	0	707	THOMSON ST #5	FLINT	
LF89521	10/30/2015	Lead	1	Copper	0	609	THOMSON ST APT #1	FLINT	48503
LG08537	2/3/2016	Lead	0	Copper	0	614	THOMSON ST APT 1	FLINT	48503
LG42808	5/5/2016	Lead	0	Copper	0	3121	THORNTON AVE APT A	FLINT	48504
LG28226	3/25/2016	Lead	0	Copper	0	2513	TIFFIN ST	FLINT	48504
LG09855	2/5/2016	Lead	10	Copper	100	2522	TIFFIN ST	FLINT	48504
LG27882	3/24/2016	Lead	0	Copper	0	2530	TIFFIN ST	FLINT	48504
LG09472	2/4/2016	Lead	6	Copper	0	2533	TIFFIN ST	FLINT	48504